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Oak Ridge Y-12 Plant Review of Lessons Learned of the Tokaimura Criticality Accident

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Introduction

The criticality accident at the JCO facility in Tokaimura, Japan has been characterized as Japan's worst nuclear power-related disaster. It eventually claimed the lives of Hisashi Ouchi and Masato Shinohara, and exposed more than 400 others to higher-than-normal levels of radiation. The accident underscored the importance of continuous improvements in nuclear safety. Upon notification of the criticality accident, the Y-12 Nuclear Criticality Safety (NCS) Division proactively initiated efforts to review whether similar vulnerabilities that contributed to the incident existed at the site.

Description

Y-12 NCS personnel faced several challenges in developing a strategy for reviewing the lessons learned from the Tokaimura incident. Preliminary information about the cause of the accident was initially incomplete and inconclusive. Y-12 Plant resources were limited and had to be diverted from other important projects. Despite these obstacles, NCS personnel developed and implemented a comprehensive assessment plan with lines of inquiry based on the *Review Plan for DOE Contractor Criticality Safety Program* developed by the Department of Energy Office of Nuclear and Facility Safety. The Y-12 assessment plan contained Criteria Review and Approach Documents (CRADS) developed for several primary areas and lines of inquiry for each performance objective of the plan. The performance objectives were structured so those reviewers could determine whether controls are being adhered to, and adequate procedures exist and are used.

The assessment plan focused on providing a means for determining whether adequate programmatic guidance is in place, personnel understand their roles and responsibilities, and personnel demonstrate a clear understanding of the criticality safety operating limits and requirements that may be specified in the maintenance work packages. The scope included a review of selected criticality safety evaluations (CSEs), criticality safety approvals (CSAs) and criticality safety requirements (CSRs) with concentration on processes that handle enriched uranium solutions. The assessment plan also provided for walk downs of

selected process areas, observation of maintenance activities, and observation of procedures and other Facility Programs/interfaces to determine effectiveness of implementation and protection of NCS controls.

Review teams were established consisting of Y-12 Plant personnel knowledgeable in the areas of Operations, Engineering, Training, and Criticality Safety. The teams consisted of NCSD engineers, Process Engineers or Subject Matter Engineers from Operations, Design Engineers from Engineering and representatives from the Training Department. Since some of these team members were inexperienced in conducting assessments, training sessions were conducted in assessment methodology and protocol.

The major emphasis effort was focused on those processes that handle fissile solutions, processes involving unfavorable geometry containers (generally, waste collection and handling), and the adequacy of active and passive design features. Processes reviewed included Chemical Recovery and Special Processing CSE/CSRs, which have some semblance of the process in Tokaimura. A sampling method was used for the balance-of-plant areas where selected processes were reviewed against generic lessons learned from the Japan accident to ensure adequate controls exist to prevent a nuclear criticality.

Results

The Y-12 Plant review teams noted many positive elements indicative of a maturing NCS program at the plant. Recent examples include implementation of the enhanced peer review process and the increased detail and rigor of the process analysis documentation. Issues identified included the need to continue the Process Analysis upgrade project; implement improvements in NCS related postings; develop better documentation of technical basis for equipment used as passive design controls; improved implementation of the Large Geometry Exclusion Area program; and planned response to nuclear criticality accidents.

The assessment concluded that no imminent criticality safety hazards involving fissile solutions were evident. A follow-up DOE review concluded that “the NCS Division program infrastructure controlling criticality safety was in place and capable of performing its function of preventing a criticality accident.” Y-12 Plant personnel initiated corrective actions to several of the issues identified during the assessment.

We have established a well-designed program including joint walk down of processes by NCS Engineers and Operations, Operations concurrences on our Criticality Safety Evaluations process descriptions, assumptions and hazards identification, as well as formal implementation and training on each process. However, our operators still felt disenfranchise as well as confused on the basis for requirements. We had not gotten to the ***floor*** operator (hands on operator).

In order to make our program implementation effective, we took the following actions:

- After benchmarking three other sites, we adopted the Criticality Safety Officer concept. A person internal to operations that is key in facilitating floor operator to NCS analyst communications, ensuring implementation of requirements, and conducting self assessments of effectiveness

- Established internal Operations NCS Improvement teams (with NCS analysts an integral part). This encouraged improvement ideas flowing up from the floor. In addition, there was a lack of feedback to the operators when ideas could not be implemented.

- This exchange of ideas and feedback to the floor operators was also enhanced by a series of Small Group Seminars. A few operators and the NCS analyst on the floor in an interactive question/answer format.

- Increased emphasis on work planning including pre-job briefs and fissile material control procedure/forms.

Recently the Plant finished an ISM implementation self-assessment. The overlap with our Tokaimura related NCS assessment was extremely high.

Conclusions

Already we are receiving favorable comments from floor operators showing their belief in the sincerity of these improvements. Such a cooperative, interactive environment in concert with a program to constantly review effectiveness of requirements implementation is essential to implementing a world-class program.

In summary, the self-assessment confirmed that a safety culture exists at the Y-12 Plant that does not allow dangerous operations to take place.

References

Review Plan for DOE Contractor Criticality Safety Programs, US DOE Office of Nuclear and Facility Safety, EH-3, Office of Environment, Safety and Health, Self Improvement Workshop, Las Vegas, Nevada, August 3-4, 1999

Distribution:

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